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COMPARATIVE WORK ENVIRONMENT PERCEPTIONS OF OPERATING PERSONNEL WITHIN EXPERIMENTAL AND STANDARD COMMUNICATION SYSTEMS

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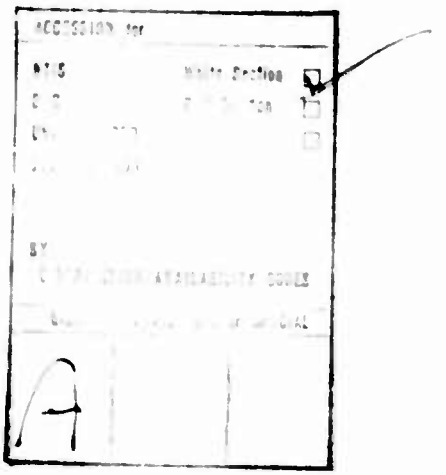

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An experimental semi-automated field communication system was evaluated in comparison with the current standard communication system. Scanners in the experimental system and operators and transcribers on the standard system completed two questionnaires dealing with past training and experience and perceptions of jobs in the system. Responses were analyzed with special reference to acceptability of the equipment and working aids, adequacy of job assistance and performance feedback, superior/subordinate and peer/peer interaction, and the individual's perception of his role in the system.

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20. Results showed that the system being evaluated was superior to the standard system. Neither system provided adequate procedures for man-man interaction. Insufficient feedback on performance, and little positive recognition, guidance or job assistance were provided for operating personnel. Work aids were generally unsatisfactory.

Personnel were able to perform for longer periods of time with less noticeable fatigue in the experimental system than in the standard system.

The research has provided leads for improving motivation through improved utilization of feedback information and the evaluation of such feedback in terms of system productivity.

Research Report 1180

AD

COMPARATIVE WORK ENVIRONMENT PERCEPTIONS OF OPERATING PERSONNEL WITHIN EXPERIMENTAL AND STANDARD COMMUNICATION SYSTEMS

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Monitor Performance

ARI Research Reports and Technical Papers are intended for sponsors of R&D tasks and other research and military agencies. Any findings ready for implementation at the time of publication are presented in the latter part of the Brief. Upon completion of a major phase of the task, formal recommendations for official action normally are conveyed to appropriate military agencies by briefing or Disposition Form.

FOREWORD

The research reported here was accomplished by the Team Performance Technical Area, Organizations and Systems Research Laboratory of the U.S Army Research Institute for the Behavioral and Social Sciences. This effort was accomplished under the Human Performance Capability Work Unit Area within the Army Research Institute (ARI), which has as its primary objective the improvement of performance in Army monitor jobs, with special emphasis on developing and testing new work methods. The entire work unit area is responsive to objectives of Army Project 2Q162106A723, "Human Performance in Military Systems," FY 1975 Work Program. Further studies in this area are being accomplished under the Organizational Development Work Unit Area.

The complex weapons and surveillance systems of the modern Army have created a relatively new series of jobs requiring operators to monitor instrument panels, radarscopes, communication nets, and other types of detection apparatus. The Human Performance Capability Work Unit Area deals with the many personal, environmental, and situational variables affecting human performance in the detection and analysis of a broad variety of signals. An important segment of the research is devoted to work environment factors and communication analysis and processing. The present Research Report evaluates an experimental semi-automated system in comparison with the standard procedure through a survey of operating personnel.

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COMPARATIVE WORK ENVIRONMENT PERCEPTIONS OF OPERATING PERSONNEL WITHIN EXPERIMENTAL STANDARD COMMUNICATION SYSTEMS

BRIEF

Requirement:

As part of a comprehensive research program to optimize the work environment in field communication systems, to evaluate an experimental semi-automated system in comparison with the current standard system.

Procedure:

During a 5-month overseas performance evaluation of the experimental system in 1970-71, scanners in the system and operators and transcribers in the standard system completed two questionnaires, one dealing with past training and experience related to communications and the other with individual perceptions of jobs in the systems. Personnel in the experimental system answered in relation to it and the job in the standard system in which they had previously worked. Responses were analyzed with special reference to acceptability of the equipment and working aids, adequacy of job assistance and performance feedback, supervisor/subordinate and peer/peer interaction, and the individual's perception of his role in the system.

Findings:

Equipment and related work procedures of the experimental system were considerably improved over those of the standard processing system.

Neither system provided adequate procedures for man-man interaction.

There was insufficient feedback on performance and practically no positive recognition of work well done.

There was insufficient guidance and job assistance from the system regarding ways of improving performance. In fact, personnel in both systems reported peer contact--not supervisor personnel--as the major source of job information and technical assistance.

There was little understanding among many personnel of the importance of their work role to the overall success of the communication processing system and the mission concerned.

Working aids, as distinguished from the electronic equipment, were generally unsatisfactory. The scanners indicated that the new system offered no improvement over the standard system in this respect, and several of them rated the new aids inferior to the old.

Personnel reported that they were able to perform for longer periods of time with no noticeable fatigue in the experimental system than in the standard system. However, they also noted that their performance was at a lowered level of proficiency after the first two hours.

Utilization of Findings

The research has provided leads for improving the motivation of individuals in the system through improved utilization of feedback information and the evaluation of such feedback in terms of system productivity.

In addition to providing immediate recommendations for system improvement, ARI has expanded its work environment research to other major fixed plant processing systems.

COMPARATIVE WORK ENVIRONMENT PERCEPTIONS OF OPERATING PERSONNEL WITHIN EXPERIMENTAL AND STANDARD COMMUNICATION SYSTEMS

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TABLES

COMPARATIVE WORK ENVIRONMENT PERCEPTIONS OF OPERATING PERSONNEL WITHIN EXPERIMENTAL AND STANDARD COMMUNICATION SYSTEMS

An increased volume of communication to be processed led the Army to develop an experimental semi-computerized information processing system for both fixed plant and future tactical operations.

Traditionally, the efficiency of a military system has been evaluated solely in terms of the quality of the electronic equipment and ease of operation at the man-machine interface. Human factors in the work environment, which have an important influence on operator productivity and satisfaction, have gone unmeasured. Deficiencies in the work environment can cause even the most sophisticated electronic system to operate below the desired level of efficiency. For example, if men operating the system are not informed as to how important their individual job performance is to the success of the entire system they are not likely to do their best, and they may even fail to keep their performance at an adequate level. As a result, total system performance may fail to meet mission requirements. The total success of any system can be ascertained only when the effects of work environment factors relevant to the performance of the men in the system have been measured and taken into account.

With the shift to a Modern Volunteer Army and the need to retain highly skilled enlisted personnel in the Army's communication systems, problems of the work environment become crucial. These problems can be resolved only by an effective research program which identifies and takes into consideration important work environment factors such as feedback and other interpersonal communication.

Recognizing that the efficiency of any such system is a joint function of the performance of the equipment and of the personnel operating the equipment, Army elements requested ARI scientists to participate in evaluating work environment factors influencing human performance. Three major sets of work environment factors were investigated: 1) man-machine interface--system equipment as used by personnel, 2) man-man interface--performance feedback, job assistance, and supervisor-subordinate and peer-peer interactions, 3) work procedures, working aids, and job fatigue.

The experimental system underwent overseas performance evaluation during the months September 1970 to February 1971. In the present report, the adequacy of the work environment, as perceived by men operating the system, is assessed. The research represents the first phase in the ARI program whose ultimate goal is to optimize the work environment of field communication systems. The experimental system was compared to the standard communication system. The focus was on how the men in the system perceive the work environment in which they perform their function. Related industrial research has clearly demonstrated that such perception directly influences worker productivity and job satisfaction.

The collection of information of field communications personnel perceptions served to pinpoint problems of work environment and enabled ARI researchers to devise ways in which some immediate improvements could be made in the system.

PROCEDURE

Personnel perceptions were obtained for various aspects of the man-machine interface, the man-man interface, and other work environment factors in two first-echelon communication processing systems. One system was the current standard operating system at an overseas station; the other system was an experimental semi-computerized one recently developed.

Seventy-six voice processors participated in the evaluation--13 scanners in the experimental system and 40 operators and 23 transcribers assigned to the standard system. The scanner job integrates into one position certain job functions of the two standard system jobs.

Personnel in both systems completed a biographical data questionnaire on their related training and experience and a job information questionnaire on one or more of three jobs in which they had prior experience. Thus, the 76 subjects completed 104 questionnaires--58 from operators, 33 from transcribers, and 13 from scanners. The biographical data blank was designed to collect information on all job-related training, either military or civilian, and any job-related experience since entering the military. In total, 64 items of biographical information were collected for each enlisted man. The job information questionnaire dealt with worker perceptions of 1) the man-machine interface, 2) the man-man interface, that is, the procedures for supervisor-subordinate and peer-peer interaction, and 3) other work environment factors.

Communication personnel evaluated the man-machine interface along four dimensions: 1) acceptability of equipment, 2) frequency of use of a given piece of equipment, 3) ease of operation, and 4) importance of each to the total job.

Work procedures were evaluated for both the man-machine and the man-man interface. Questions directly concerning the man-man interface and other work-environment factors of the system concentrated on 1) usefulness of the job working aids, 2) adequacy of performance feedback and job assistance information within the system, 3) degree of job fatigue experienced, 4) adequacy of superior interaction with subordinates and interactions with peers, 5) importance of formal and informal training to job success, and 6) the individual's understanding of the contributions his work role makes to total system output.

FINDINGS

Man-Machine Interface

The equipment component of the man-machine interface for both systems was rated acceptable and easy to operate by the majority of personnel. Approximately 91% of the operator equipment and 75% of the transcriber equipment in the standard system was rated as acceptable as compared with 96% of the equipment in the experimental system. Only the CRT keyboard and tape recorder knee switch in the experimental system received somewhat unsatisfactory ratings.

Work Procedures, Working Aids and Job Fatigue. Work-procedure ratings indicate substantial improvement for the system in comparison to standard system procedures. All scanners rated the overall experimental work procedures as an improvement over the standard system. Approximately three-fourths of the standard system operators and transcribers were dissatisfied with the overall standard system work procedures while only 7% of experimental personnel reported dissatisfaction. However, a detailed analysis of individual work-procedure ratings showed improvement only in equipment related procedures and not in the man-man (subordinate/superior communication) procedures. In fact, the level of satisfaction of new system operators with peer interactions was slightly below the level of standard system operators.

For the present investigation, working aids were defined as any instruments provided to aid the worker in performing the human functions required by his job--a dictionary, for example. The working aids available in both systems were judged unsatisfactory by at least one-half the operating personnel in both systems. Further, the majority of scanners rated the experimental working aids as no better than those of the standard system. In fact, 15% of the scanners believed the experimental working aids were actually less effective than those available in the standard system.

Fatigue data revealed that almost all experimental system scanners felt that they could operate with no noticeable fatigue for longer periods of time than standard system personnel. While 63% of the operators and 80% of the transcribers reported fatigue within the first four hours of operation, only 5% of the scanners reported noticing fatigue in the same period.

However, a surprising 64% of the scanners, compared to 18% of the operators and 20% of the transcribers in the standard system, believed that within the first two hours of operation there was a loss in their ability to perform their job with peak efficiency. When questioned, the scanners were unable to pinpoint the source of this unexpected fatigue, although they did report the equipment, per se, not to be the source of the difficulty. The exact cause of this loss in performance capability can be determined only by exhaustive experimentation.

While general improvements were noted in the man-machine interface of the experimental system and its equipment-related work procedures, no similar improvements were reported for the man-man interactions and related work-environment factors.

Performance Feedback. A large percentage of personnel in both systems reported dissatisfaction with the level of performance feedback. Seventy-five percent of the standard system operators, 92% of the standard system transcribers and 50% of the experimental scanners perceived a need for increased information regarding the quality of their performance. The major source of performance feedback in both systems was reported to be peers, not superiors. When these data were considered in relation to experience and formal training, it was evident that in the standard system the inexperienced operators of lower rank believed that they received less information regarding their performance than any other personnel element.

Similar high percentages of personnel in both systems reported a lack of positive feedback from their superiors for good performance. Of the experimental scanners, 92% stated they received no praise for good performance; 60% of the standard system operators and 75% of the transcribers made the same report. Much of the limited feedback given by superiors in both systems was for unsatisfactory job performance.

Job Assistance. Personnel in both systems reported need for greater assistance in performing their jobs. Forth-six percent of the standard system operators, 33% of its transcribers, and 42% of the new system scanners reported that they seldom received job assistance information from the direct user of their product (the analyst). At least 75% of the personnel in each system believed such information would benefit the quality of their performance. At present, the overwhelmingly major source of job assistance information reportedly comes from peers and not from superiors. In fact, only two of the 13 new system scanners and one standard system transcriber reported receiving any job assistance from a superior.

Personnel also believed that the major source of assistance in acquiring the technical skill necessary to perform their jobs was interaction with peers rather than formal job training, or training at Army or Department of Defense service schools. Although 85% of the scanners felt less need for peer contact in the experimental system than in the standard system, 40% of them believed more contact with their fellow workers would benefit their job performance. Similar percentages of standard system personnel believed more peer contact would benefit their performance.

Perceived Importance of Work Role. Perceptions of job importance can influence the worker's productivity and morale. The majority of personnel in the standard system did not perceive their work roles to be important to the success of the total system. Percentages were 70% of the operators and 55% of the transcribers. In contrast, only 15% of the experimental system scanners believed their job to be unimportant. Less experienced operators perceived their jobs to be less important for the success of the mission than did operators with more training and experience.

Many men in both systems believed that their superiors did not recognize the importance of the subordinate's role in the total system. In the standard system, 64% of the operators and 55% of the transcribers believed that their superiors did not recognize the importance of the subordinate's role. The corresponding figure for the scanners was 30%.

SUMMARY OF FINDINGS

The equipment interface of the experimental system and its related procedures were perceived by personnel working in the system to be a general improvement over the standard system. However, significant improvements were preceived to have been made only in the man-machine interface and equipment. In general, no similar improvements were perceived for the man-man interface and related work-environment factors. Personnel in the new experimental system were not more satisfied with their jobs than personnel in the standard system. In this connection, standard system personnel indicated greater satisfaction with the equipment and the man-machine interface than had been expected. Personnel in both systems reported high levels of dissatisfaction with several aspects of the human work environment.

Neither system provided adequate procedures for man-man interaction.

There was insufficient feedback on performance and practically no positive recognition of work well done.

There was insufficient guidance and job assistance from the system regarding ways of improving performance. In fact, personnel in both systems reported peer contact--not supervisor personnel--as the major source of job information and technical assistance.

There was little understanding among many personnel of the importance of their work role to the overall success of the communication processing system and the mission.

Working aids, as distinguished from the electronic equipment, were generally unsatisfactory. The scanners indicated that the new system offered no improvement over the standard system in this respect, and several of them rated the new aids inferior to the old.

The experimental system personnel reported that they were able to perform for longer periods of time with no noticeable fatigue in the new system than in the standard system. However, they also noted that their performance dropped to a lower level of proficiency after the first two hours.

IMPLICATIONS OF FINDINGS

The dissatisfaction reported by experimental system scanners is the more significant in light of the attention paid to their work activities by everyone connected with the system. The scanners were certainly aware of this attention, as shown by the fact that only 15% reported that their work role was not important as compared with 7% of the standard system operator personnel. Previous research[1] indicates that such attention has a positive effect on job attitudes and performance (this positive effect is known as the Hawthorne effect).

If the Hawthorne effect was operating in the present experiment, then future attitudes may be expected to be more negative as the focused attention diminishes. As a consequence, some of the perceived gains in performance may be lost over a period of time as a function of deterioration in operator job attitudes.

The data raise several research questions which will require answering before these findings can be directly applied to the operational station and future tactical work environments. First, the relationship between the perceptions of the worker and objective performance data must be determined. Second, various aspects of the external work environment and internal components of the employee's job itself must be analyzed for their relative influence upon job satisfaction and productivity. Only with this information can the work environment be effectively redesigned for optimum human performance.

With the development of the all-volunteer military concept and the need for retention by the Army of highly trained and skilled enlisted personnel, greater attention must be placed upon the man-man interactions and the other work-environment factors in new systems. These areas may make the critical difference in a soldier's decision whether to remain in the Army or to return to civilian life. Moreover, the influence of the man-machine interface and related equipment factors on total system effectiveness may be reaching a point of diminishing returns, and the greatest remaining pay-off for system optimization may emerge from the study of human work-environment factors.

Several immediate changes have been proposed and instituted in order to alleviate to a degree the undesirable work-environment conditions reported in both the experimental and the standard systems.

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[1] Roethlisberger, F. J. and W. J. Dickson. Management and the Worker. Cambridge: Harvard University Press, 1939.

TECHNICAL SUPPLEMENT

DATA COLLECTION AND DETAILED RESULTS OF ANALYSIS FOR EVALUATION OF THE EXPERIMENTAL SYSTEM

TESTING PROCEDURE AND MATERIALS

Personnel in both systems completed a Biographical Experience-Training Questionnaire and a Job Information Questionnaire (Appendix) for each of three jobs in which they had prior experience. Jobs evaluated were the operator and transcriber positions of the standard system and the analogous scanner position in the experimental system.

These self-administered questionnaires were completed during the normal working hours of the participants. Personnel were then interviewed by ARI scientists and any ambiguous questionnaire replies were clarified.

The Biographical Experience-Training Questionnaire

Sixty-four items of information about training and experience were collected from each processor through the self-administered questionnaire. Questions centered upon previously military and civilian training and experience. Since prior experience and training may influence job perceptions, the following items of biographical data were chosen for correlational analysis:

RANK: SP4; SP5; SP6; other.

TIME IN MOS: 1 year or less; 1-2 years; more than 2 years.

TIME AT STATION: 6 months or less; 6-12 months; 1-2 years; more than 2 years.

PRIMARY DUTY: Scanning; transcription; gisting; analysis and reporting.

SCANNING EXPERIENCE: none; 3 months or less; 3-6 months; 6-12 months; more than 1 year.

TRANSCRIPTION EXPERIENCE: none; 3 months or less; 3-6 months; 6-12 months; more than 1 year.

GISTING EXPERIENCE: none; 3 months or less; 3-6 months; 6-12 months; more than 1 year.

ANALYSIS AND REPORTING EXPERIENCE: none; 3 months or less; 3-6 months; 6-12 months; more than 1 year.

ATTENDANCE AT THE FOLLOWING TRAINING COURSES: Department of Defense (DoD) Aural Comprehension, Extended Course, Advanced Course; Army Service School Common-Block, Army Service School Target Block, Army Service School Add-On Course.

YEARS OF FORMAL LANGUAGE TRAINING (OTHER THAN DoD): none; 2 years or less; more than 2 years.

The Job Information Questionnaire (JIQ) was divided into two major sections. Section one dealt with the degree of worker satisfaction with various equipment items in the man-machine interface of the two systems. Each piece of equipment used in the standard system operator and transcriber positions and in the experimental scanner position was evaluated along four separate dimensions using five-point scales. The dimensions and scales utilized were as follows:

ACCEPTABILITY:

Completely Acceptable	Acceptable	Average	Unacceptable	Completely Unacceptable

FREQUENCY OF USE:

Always	Often	Occasionally	Seldom	Never

IMPORTANCE:

Very Important	Above Average	Average	Below Average	Unimportant

EASE OF OPERATION:

Easy	Fairly Easy	Standard	Fairly Difficult	Difficult

Section two of the Job Information Questionnaire dealt with work procedures, the man-man interface, and other work-environment factors. Degree of worker satisfaction was obtained for both the overall work procedures, man-machine, and man-man procedures. A five-point scale ranging from Completely Satisfactory to Completely Unsatisfactory was utilized.

For the man-man interface and other work-environment information, individual five-point scales were adapted to the particular information desired. In these areas, questions centered upon 1) utility of working aids, 2) adequacy of performance feedback and job aid information, 3) degree of job fatigue, 4) satisfaction with superior-subordinate and peer interactions, 5) perceived importance of formal training to job success, and 6) understanding of job role for system success. In addition, the JIQ asked scanners for a comparison of certain procedures and work environment factors in the two systems. A sample copy of the Job Information Questionnaire is provided as the Appendix.

Data Analysis

A total of [illegible] Job Information Questionnaires were completed for the standard system operator position, [illegible] questionnaires for the transcriber position, and [illegible] questionnaires for the experimental system scanner position. A number of the [illegible] subjects had experience in more than one position and completed more than one questionnaire. Because of the small number of personnel operating the experimental system, statistical analysis was limited to percentage comparisons between systems. Pearson correlation coefficients between training-experience data and JIQ responses were limited to the operator and transcriber positions of the standard system.

RESULTS

Man-Machine Interface

Thirty-four pieces of operator apparatus, [illegible] pieces of transcriber apparatus, and [illegible] pieces of experimental system equipment were evaluated by personnel. Each of these equipment items was rated in terms of its acceptability, frequency of use, ease of operation, and importance.

For the standard system operator position, [illegible] of the [illegible] pieces of apparatus were rated as acceptable by at least [illegible]% of the operators. Only the earphones, intercom, and microphone were rated as unacceptable by more than [illegible]% of the operators. Table [illegible] shows the ratings for these items on all four dimensions. For the transcriber position, [illegible] of the [illegible] pieces of apparatus were rated as acceptable by at least [illegible]% of the personnel. Exceptions were the earphones, typewriter, recorder foot-pedal, millpaper, and speed control switch (Table [illegible]).

Ninety-one pieces of experimental system apparatus were evaluated. Ninety-six percent of this equipment was rated as acceptable and easy to use by all the scanners. Only the CRT keyboard and the recorder knee switch were rated unacceptable by more than [illegible]% of the scanners (Table [illegible]). Of these two pieces of equipment, only the CRT seems critical for inclusion in the final system, since alternative apparatus can be utilized to perform the functions of the knee switch.

Table 1

RESPONSES OF STANDARD SYSTEM OPERATORS
ON EQUIPMENT ITEMS CONSIDERED UNACCEPTABLE

Equipment Item	Unacceptable	PERCENT RESPONDING Difficult	Freq. Use	Important
Earphones	75%	20%	80%	80%
Intercom	29%	24%	10%	21%
Microphone	18%	14%	77%	53%

Table 2

RESPONSES OF STANDARD SYSTEM TRANSCRIBERS
ON EQUIPMENT ITEMS CONSIDERED UNACCEPTABLE

Equipment Item	Unacceptable	PERCENT RESPONDING Difficult	Freq. Use	Important
Earphones	93%	51%	97%	97%
Footpedal	74%	27%	60%	63%
Millpaper	27%	30%	100%	82%
Typewriter	54%	36%	100%	91%
Speed Control Switch	27%	15%	82%	91%

Table 3

RESPONSES OF EXPERIMENTAL SYSTEM SCANNERS
ON EQUIPMENT ITEMS CONSIDERED UNACCEPTABLE

Equipment Item	Unacceptable	PERCENT RESPONDING Difficult	Freq. Use	Important
Knee Switch	38%	8%	16%	42%
CRT Keyboard	18%	0%	100%	100%

Work Procedures. Work procedure ratings indicated that the experimental system was a substantial improvement over the standard system (Table 4). All scanners rated the overall new work procedures an improvement over the standard system. However, a detailed analysis of individual ratings showed that the improvement reported for the experimental system was only in equipment-related procedures and not in the man-man interface aspect of the work procedures. In fact, the level of satisfaction of experimental system scanners with peer interactions was slightly below the level of standard system operators.

Working Aids. Sixty-seven percent of the standard system operators, [illegible] of its transcribers, and [illegible] of the scanners were dissatisfied with the available working aids. Table [illegible] shows an evaluation by the scanners of the experimental working aids compared to the standard aids. No substantial improvement is indicated. In fact, [illegible] of the scanners rate the quality of the experimental working aids below those of the standard system.

Job Fatigue. Scanners perceived that they could operate in the new system for considerable longer periods of time without first noticeable fatigue than did standard system personnel. As can be seen in Table [illegible], only [illegible] of the scanners reported fatigue in the first four hours of duty, whereas [illegible] of the standard system operators and [illegible] of the transcribers reported fatigue in the same period of time. In contrast, [illegible] of the scanners indicated a decrease in peak work capability within the first two hours of operation, while only [illegible] of the standard system operators and [illegible] of the transcribers reported similar feelings. These data will be found in Table [illegible]. The source of this fatigue was not determined in this study.

Since fatigue levels may be related to work schedule, personnel were asked to indicate their preference for fixed or rotating shifts. If they chose a fixed shift schedule, they were asked to indicate their preference for the day, evening, or midnight shift. As shown in Table [illegible], the great majority of personnel in both systems preferred a fixed shift schedule. Furthermore, these work schedule preferences seem to conform closely with the production needs of the operating station.

Man Man Interface

Performance Feedback and Job Assistance Information. Table [illegible] shows that a large percentage of personnel in both systems reported dissatisfaction with the level of performance feedback. In addition, [illegible] of the scanners believed performance feedback levels in the new system had not improved over standard system conditions and [illegible] reported that they received no feedback at all from the system. Of the feedback which was received from superiors, only a small percentage was for good work.

Table 4

COMPARATIVE WORK PROCEDURE RATINGS
FOR STANDARD AND EXPERIMENTAL SYSTEMS

Procedures	PERCENT RESPONDING UNSATISFACTORY Standard System Transcriber Job (N=33)	Experimental System Scanner Position (N=13)
Receiving Message	33%	0%
Auditing Message	45%	0%
Writing Message	30%	0%
Sending Message	20%	0%
Contacting Superior	30%	33%
Contacting Peers	15%	33%

Table 5

EVALUATION OF EXPERIMENTAL SYSTEM WORKING AIDS
COMPARED TO STANDARD SYSTEM AIDS

Experimental Working Aids Rated	Scanners Responding
Superior	23%
No Improvement	62%
Inferior	15%

Table 6

FIRST NOTICEABLE JOB FATIGUE

Hours on duty	STANDARD SYSTEM Operator	Transcriber	EXPERIMENTAL SYSTEM Scanner
0-2	43%	22%	8%
3-4	25%	37.5%	0%
5-6	18%	28%	15%
7-8	14%	12.5%	77%

Table 7

PERCEIVED CONTINUOUS WORK CAPABILITY

Hours on duty	STANDARD SYSTEM Operator	STANDARD SYSTEM Transcriber	EXPERIMENTAL SYSTEM Scanner
0-2	16%	28%	64%
3-4	12%	2[illegible]%	9%
5-6	20%	2[illegible]%	18%
7-8	44%	16%	9%

Table 8

PREFERRED WORK SCHEDULES

	STANDARD SYSTEM Operator	STANDARD SYSTEM Transcriber	EXPERIMENTAL SYSTEM Scanner
Fixed:	91%	94%	85%
Day:	28%	37.5%	39%
Eve:	45%	37.5%	23%
Mid:	18%	19%	23%
ROTATING:	9%	6%	15%

Table 9

REPORTED PERSONNEL SATISFACTION WITH PERFORMANCE FEEDBACK

	STANDARD SYSTEM Operator Job (N=[illegible])	STANDARD SYSTEM Transcriber Job (N=33)	EXPERIMENTAL SYSTEM Scanner Job (N=13)
Unsatisfactory Feedback on Performance	75%	[illegible]2%	50%
No Praise for Good Work	[illegible]0%	75%	91%

Pearson correlation coefficients of these feedback data with training and experience variables indicated that the inexperienced, lower ranked operators of the standard system believed that they received the least information on their performance (Pearson r between experience and desire for performance information was -.32, $p < .05$; Pearson r between military rank and desire for performance information was -.[illegible] $p < .01$).

Personnel in both systems reported a need for greater amounts of information in order to perform their jobs satisfactorily. Similar high percentages of personnel in both the new and old systems reported that they seldom or never received any job assistance from the direct user of their product (the analyst). The scanners reported even less job assistance from the analyst than did the transcribers of the standard system (Table 10). In addition, 75% of the standard system operators, [illegible]% of its transcribers, and 75% of the scanners felt that more guidance would have benefited their performance.

Peer contact was perceived by personnel in both systems as the major source of job aid information and technical assistance. As shown in Table 11, personnel in both systems equally perceived the major source of job assistance to be peers and not superiors. Table 12 indicates that personnel in both systems also believed that the major source of technical skill necessary to perform their jobs was interactions with peers, and not formal job or service school training. Peer contact appears to be a necessary factor for successful job performance in either system. In addition, 91% of the standard system operators, [illegible]% of the transcribers, and [illegible]% of the scanners reported at least occasional contact of peers for job assistance during each working day. Although [illegible]% of the scanners reported less need for peer assistance in operating the experimental system than in the standard system, 40% of these men believed that additional peer contact would further benefit their performance. In the standard systems 40% of the operators and 30% of the transcribers desired more peer contact.

Perceived Importance of Work Role. Less than half the personnel in the standard system perceived their job as important to the success of the mission. In contrast, as shown in Table 13, [illegible]% of the new system personnel believed their job to be important. Furthermore, only 30% of the standard system operators and 45% of its transcribers believed that their superiors who were removed from the field site realized the importance of the subordinates' jobs. Surprisingly, only 62% of the experimental system personnel believed that their superiors were cognizant of the importance of the scanner role in the success of the mission. The above experimental system data must be interpreted with great care since it is highly possible that the Hawthorne effect was operating at the time of data collection.

Table 10

PERSONNEL RATINGS FOR DEGREE OF JOB ASSISTANCE
INFORMATION RECEIVED FROM ANALYST

	STANDARD SYSTEM		EXPERIMENTAL SYSTEM
	Operator Job	Transcriber Job	Scanner Job
Seldom/Never:	46%	33%	42%
Occasional:	40%	42%	25%
Frequent:	14%	25%	33%

Table 11

MAJOR SOURCE OF JOB ASSISTANCE INFORMATION

	STANDARD SYSTEM		EXPERIMENTAL SYSTEM
	Operator Job	Transcriber Job	Scanner Job
Peers:	68%	97%	85%
Trick Chief:	19%	3%	7.5%
Supervisor:	13%		7.5%

Table 12

MAJOR SOURCE OF PERCEIVED TECHNICAL JOB SKILL

	STANDARD SYSTEM		EXPERIMENTAL SYSTEM
	Operator	Transcriber	Scanner
Peers:	50%	37%	45%
On-the-job training:	22%	30%	22%
Service school:	24%	22%	11%
DoD school:	2%	11%	11%

Table 13

PERCEIVED DEGREE OF JOB IMPORTANCE

	STANDARD SYSTEM		EXPERIMENTAL SYSTEM
	Operator	Transcriber	Scanner
Important:	24%	43%	85%
Moderately Important:	43%	30%	7.5%
Unimportant:	33%	21%	7.5%

THE RELATIONSHIP OF TRAINING AND EXPERIENCE TO JOB INFORMATION QUESTIONNAIRE RESPONSES

Ten items of training and experience information, described previously, were intercorrelated with responses to all items of the Job Information Questionnaire for the standard system operator and transcriber. The limited number of meaningful correlations found are described below. Correlations were not computed for the experimental system because of the limited number of operational personnel.

The Operator Position

Experience variable correlations for the operator position indicate that the lower ranked operator was less satisfied with 1) the amount of performance feedback (Pearson $r = -.38$, $p < .01$), and 2) the perceived importance of his job to the success of the system (Pearson $r = -.36$, $p < .01$). Furthermore, the less experienced the operator in his job, the less job aid information he perceived that he received from the system (Pearson $r = -.32$, $p < .05$).

For training variables, individuals who attended the DoD intermediate course reported less dissatisfaction with the earphones (Pearson $r = .30$, $p < .05$). Those individuals who attended the DoD extended course indicated less dissatisfaction with the procedures for auditing messages (Pearson $r = .34$, $p < .05$). Finally, those individuals who did not attend the Army common block course felt their job to be significantly more important to the success of the system's mission (Pearson $r = -.35$, $p < .01$).

The Transcriber Position

The less experience the transcriber had the more dissatisfaction he reported with the system's overall work procedures (Pearson $r = .34$, $p < .05$). In addition, higher ranked transcribers reported receiving significantly greater job assistance information (Pearson $r = .46$, $p < .01$). Transcribers whose primary duty was gisting felt a significantly greater need for job assistance information from the analyst than did other transcribers (Pearson $r = .35$, $p < .05$). This finding may become especially critical as new systems change from transcribing to gisting procedures. As with the operator, feedback of all forms seem to be most critically missing for the new and inexperienced transcriber.

Personnel who attended the Army add-on course expressed greater levels of satisfaction with the procedures for writing and sending gists (Pearson $r = .43$, $p < .05$ and $r = .45$, $p < .05$). These same people reported that they asked for more advice from their peers (Pearson $r = -.44$, $p < .05$) and that this contact benefited their performance (Pearson $r = -.43$, $p < .05$).

APPENDIX

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ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES
SYSTEM EVALUATION QUESTIONNAIRE

NAME: _____ DATE: _____

RANK: _____ SOCIAL SECURITY NUMBER: _____

POSITION TO BE EVALUATED (check one): _____ SCANNER

_____ OPERATOR

_____ TRANSCRIBER

HOW MUCH EXPERIENCE IN POSITION TO BE EVALUATED (WEEKS, MONTHS OR YEARS)? _____

THIS STUDY IS DIRECTED TOWARD THE IMPROVEMENT OF THE OVERALL EFFICIENCY OF THE FIRST ECHELON PROCESSING SYSTEM. YOUR JOB IS CRITICAL TO THE SUCCESS OF THE PROCESSING SYSTEM. IN ORDER TO ADEQUATELY EVALUATE YOUR POSITION HONEST ANSWERS ARE REQUIRED TO THE QUESTIONS ASKED ON THE FOLLOWING PAGES.

THIS QUESTIONNAIRE IS DIVIDED INTO TWO MAJOR SECTIONS. SECTION ONE IS CONCERNED WITH THE EFFICIENCY OF THE EQUIPMENT AND THE PROCEDURES USED BY YOU IN PERFORMING YOUR JOB. SECTION TWO IS CONCERNED WITH ADDITIONAL HUMAN FACTORS WHICH MAY INFLUENCE YOUR EFFICIENCY.

SECTION ONE

INSTRUCTIONS:

1. IN THE FOLLOWING ITEMS YOU WILL BE ASKED TO EVALUATE THE EQUIPMENT AND PROCEDURES OF YOUR JOB ALONG FOUR DIMENSIONS. THESE ARE:

A.	EASE OF OPERATION:	THE EFFICIENCY AND ADAPTABILITY OF THE EQUIPMENT AND PROCEDURES FOR THE JOB.
B.	ACCEPTABILITY:	IS THE EQUIPMENT OR PROCEDURE AS PRESENTLY CONFIGURED SATISFACTORY?
C.	FREQUENCY OF USE:	HOW OFTEN IS THE ITEM OF PROCEDURE USED BY YOU IN PERFORMING YOUR JOB?
D.	IMPORTANCE:	HOW CRITICAL IS THE FAILURE OF THE ITEM OR PROCEDURE TO THE SUCCESSFUL PERFORMANCE OF YOUR JOB?

2. YOU ARE TO RATE EACH ITEM OR PROCEDURE ON THE FOUR DIMENSIONS (EASE, ACCEPTABILITY, FREQUENCY, AND IMPORTANCE) BY CHECKING THE SCALE VALUE (1 TO 5) WHICH BEST REFLECTS YOUR OPINION.

3. BE SURE TO ANSWER EVERY ITEM.

4. CAREFULLY DELIBERATE EACH ANSWER.

5. IF YOU WISH TO MAKE ANY ADDITIONAL REMARKS PLEASE DO SO IN THE COLUMN SPECIFIED FOR REMARKS. PLEASE INDICATE BY NUMBER THE ITEM YOU ARE REFERRING TO IN YOUR REMARKS. IF ADDITIONAL SPACE IS REQUIRED YOU MAY USE THE BACK OF THE PAGE.

6. PLEASE BE COMPLETELY HONEST AND THOUGHTFUL IN YOUR REPLIES.

THANK YOU VERY MUCH FOR YOUR COOPERATION

EQUIPMENT OR PROCEDURE	EASE OF OPERATION					ACCEPTABILITY					FREQUENCY OF USE					IMPORTANCE				
	easy	fairly easy	standard	fairly difficult	difficult	completely acceptable	acceptable	average	unacceptable	completely unacceptable	always	often	occasionally	seldom	never	very important	above average	average	below average	unimportant
Recorder																				
Tape reel holder																				
Tape threader																				
Tape counter																				
Power "on" switch																				
Speed control																				
Play gain switch																				
Record gain switch																				
Tone control																				
Earphones																				
Input/output switch																				
Play button																				
Record button																				
Fast forward button																				
Rewind button																				
Footpedal																				
Stop button																				
Volume control																				
Mill paper																				
Typewriter																				
Other equipment not listed [1]																				

[1] List below

PAGE ONE SECTION TWO

INSTRUCTIONS: PLEASE ANSWER EACH QUESTION COMPLETELY AND ACCURATELY.

1. HOW SATISFACTORY ARE THE FOLLOWING ITEMS WITHIN THE PRESENT SYSTEM? PLEASE CHECK THE STATEMENT WHICH BEST REFLECTS YOUR OPINION WITHIN EACH ITEM.

	UNSATISFACTORY extensive change required	UNSATISFACTORY some change required	SATISFACTORY little change required	SATISFACTORY no change required
A. Procedures for receiving messages				
B. Procedures for auditing messages				
C. Procedures for writing gists				
D. Procedures for sending gists				
E. Procedures for contacting supervisor				
F. Procedures for contacting fellow transcribers/gisters				
G. Work Aids				
H. Information about performance				
I. Overall work procedures				

2. IN OPERATING THE PRESENT SYSTEM FATIGUE FIRST BECOMES NOTICEABLE IN: (CIRCLE ONE)

a. less than one hour
b. 1-2 hours
c. 2-4 hours
d. 4-5 hours
e. 5-6 hours

3. IS THERE ANY PIECE(S) OF EQUIPMENT WHICH IS MOST RESPONSIBLE FOR THE FATIGUE? (CIRCLE ONE) a. yes b. no

IF YES, PLEASE LIST PIECE(S) HERE_____

_____

4. IF YOU COULD DETERMINE YOUR OWN WORK SCHEDULE FOR MAXIMUM EFFICIENCY HOW WOULD YOU ANSWER THE FOLLOWING ITEMS?

a. How many continuous hours would you transcribe/gist?_____

b. What time period would you allow for recovery?_____

c. Which would you prefer to work? (Circle one) (1) all days
(2) all eves
(3) all mids
(4) rotating

5. LIST THE WORK AIDS AVAILABLE TO YOU IN THE PRESENT SYSTEM, WHERE THEY ARE LOCATED AND HOW OFTEN YOU USE THEM.

WORK AID	LOCATION	TIMES USED PER TRICK

6. IN GENERAL THE WORK AIDS IN THE PRESENT SYSTEM ARE: (CIRCLE ONE)

a. unsatisfactory b. satisfactory c. excellent

7. WHICH WORK AID IS MOST IMPORTANT? (PLEASE LIST)

8. HOW OFTEN PER TRICK DO YOU CONSULT YOUR FELLOW WORKERS FOR ADVICE? (CIRCLE ONE)

(a) never
(b) seldom
(c) occasionally
(d) frequently
(e) very frequently

9. WOULD MORE CONTACT WITH YOUR FELLOW WORKERS AID YOU IN PERFORMING YOUR JOB? (CIRCLE ONE) (a) yes (b) no

10. WOULD YOU DESIRE MORE DIRECT SUPERVISION? (CIRCLE ONE)

(a) yes (b) no

11. HOW OFTEN DOES THE ANALYST GIVE YOU INFORMATION RELATIVE TO YOUR ASSIGNMENT? (CIRCLE ONE)

(a) never
(b) seldom
(c) occasionally
(d) frequently
(e) very frequently

12. WOULD MORE INFORMATION FROM THE ANALYST BE HELPFUL? (CIRCLE ONE)

(a) yes (b) no

13. HOW ARE YOU INFORMED OF THE ADEQUACY OF YOUR PERFORMANCE? (CIRCLE ONE)

(a) Feedback from your trick chief

(b) Feedback from your supervisor

(c) Feedback from your fellow workers

(d) other, please specify_____

14. WHEN HELP IS REQUIRED WHO DO YOU CONSULT FIRST? (CIRCLE ONE)

(a) trick chief

(b) supervisor

(c) fellow workers

(d) other, please specify_____

15. WHAT PERCENTAGE OF THE FEEDBACK ON YOUR PERFORMANCE IS FOR GOOD WORK? PLEASE SPECIFY_____

16. FROM WHICH OF THE FOLLOWING DID YOU OBTAIN MOST OF THE TECHNICAL INFORMATION NECESSARY TO PERFORM YOUR JOB? (CIRCLE ONE)

(a) DoD School
(b) Service School
(c) formal OJT
(d) supervisor
(e) fellow workers
(f) other, please specify_____

17. WHICH PART OF YOUR FORMAL TRAINING IS MOST IMPORTANT TO YOU NOW AS A TRANSCRIBER/GISTER? WHICH IS LEAST IMPORTANT? PLEASE STATE:

MOST IMPORTANT:_____

LEAST IMPORTANT:_____

18. DO YOU FEEL HIGHER ECHELONS REMOVED FROM THE STATION REALIZE THE IMPORTANCE OF YOUR WORK? (CIRCLE ONE) (a) yes (b) no

19. HOW IMPORTANT DO YOU FEEL SUCCESSFUL PERFORMANCE OF YOUR JOB IS TO THE SYSTEM? (CIRCLE ONE)

(a) very important
(b) important
(c) moderate
(d) unimportant
(e) very unimportant

20. WHAT IS THE MAJOR PRODUCT(S) OF THE PRESENT SYSTEM? PLEASE SPECIFY

_____

21. WHO ARE THE MAJOR USERS OF THE PRESENT PRODUCTS? LIST IN ORDER OF USE. PLEASE SPECIFY HERE:_____

_____

_____

_____